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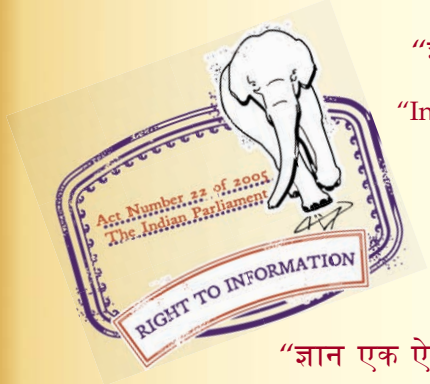
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IS 9000-17 (1985): Basic environmental testing procedures for electronic and electrical items, Part 17: Radiation test [LITD 1: Environmental Testing Procedure]



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Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 17 RADIATION TEST

(First Revision)

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BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 17 RADIATION TEST

(*First Revision*)

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Indian Standard

BASIC ENVIRONMENTAL TESTING PROCEDURES FOR ELECTRONIC AND ELECTRICAL ITEMS

PART 17 RADIATION TEST

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 17) (First Revision) was adopted by the Indian Standards Institution on 27 June 1985, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The differences in environmental testing procedures for component type items and equipment type items are fast disappearing in the context of technological developments. It is, therefore, found necessary to have uniform testing procedures wherever possible. This series of standards on environmental testing procedures (IS : 9000) has been prepared with this objective. This is also in line with the principle adopted by IEC/TC 50 'Environmental Testing' in developing unified series of standards on environmental testing procedures by International Electrotechnical Commission.

0.3 This standard (Part 17) was originally published as IS : 2106 (Part 17)-1973* and subsequently redesignated as IS : 9000 (Part 17/Sec 1)-1973†. This revision has been undertaken to line up this standard with the latest International Standards. Through this revision, this standard is also being redesignated as IS : 9000 (Part 17)-1985 covering solar radiation as Section 2 contemplated to cover nuclear radiation has been deferred.

0.4 This standard (Part 17) deals with test procedure for radiation test. Guidance details are covered by IS : 9001 (Part 11)-1973‡.

0.5 Intending users of this test are directed to the health hazards associated with tests of this nature and are therefore advised to refer to **10** of IS : 9001 (Part 11)-1973.‡

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*Environmental tests for electronic and electrical equipment: Part 17 Simulated solar radiation at ground level.

†Basic environmental testing procedures for electronic and electrical items: Part 17 Radiation test, Section 1 Solar radiation.

‡Guidance for environmental testing: Part 11 Solar radiation test. (*Redesignation* of IS : 7025-1973).

0.6 While preparing this standard, assistance has been derived from IEC Pub 68-2-5 (1975) Basic environmental testing procedures: Part 2 Tests — Test Sa : Simulated solar radiation at ground level issued by the International Electrotechnical Commission (IEC).

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 17) covers details of procedure for application of simulated solar radiaton test to electronic and electrical items as a part of basic environmental testing procedures.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part 1) - 1977† shall apply.

3. OBJECT

3.1 The object of this test is to determine the effects (thermal, mechanical, chemical, electrical, etc), produced on equipment and components as a result of exposure to solar radiation under the conditions experienced at the surface of the earth.

4. INITIAL MEASUREMENTS

4.1 The items shall be visually inspected and electrically and mechanically checked, as required by the relevant specification.

5. TEST APPARATUS

5.1 The enclosure in which the test is to be carried out shall be provided with means for obtaining, over the prescribed irradiation measurement plane, an irradiance of 1·120 kw/m^2 ± 10 percent with the spectral distribution given in Table 1. The value of 1·20 kw/m^2 shall include any radiation reflected from the test enclosure and received by the item under test. It

*Rules for rounding off numerical values (*revised*).

†Basic environmental testing procedures for electronic and electrical items: Part 1 General.

should not include longwave infra-red radiation emitted by the test enclosure [*see* 7.1 of IS : 9001 (Part 11)-1973*].

NOTE — Where only the thermal effects of solar radiation are of interest, refer to 3.2 and 3.3 of IS : 9001 (Part 11)-1973*.

TABLE 1 SPECTRAL ENERGY DISTRIBUTION AND PERMITTED TOLERANCES

(*Clause* 5.1)

SPECTRAL REGION	ULTRA-VIOLET B*	ULTRA-VIOLET A	VISIBLE			INFRA-RED
Bandwidth	0·28-0·32 μm	0·32-0·40 μm	0·40-0·52 μm	0·52-0·64 μm	0·64-0·78 μm	0·78-3.00 μm
Irradiance	5 W/m²	63 W/m²	200 W/m²	186 W/m²	174 W/m²	492 W/m²
Tolerance Percent	±35	±25	±10	±10	±10	±20

*Radiation shorter than 0·30 μm reaching the earth's surface is insignificant.

5.2 Means shall also be provided whereby the specified conditions of temperature, air flow and humidity may be maintained within the enclosure.

NOTE — Circulation of air may significantly reduce the temperature rise of items [*see* 5.5 of IS : 9001 (Part 11) -1973*].

5.3 The temperature within the enclosure shall be measured (with adequate shielding from radiation heat) at a point or points in a horizontal plan 0 to 50 mm below the prescribed irradiation measurement plane, at half the pistance between the item under test and the wall of the enclosure, or at 1 m from the item, whichever is the lesser.

6. CONDITIONING

6.1 The item to be tested shall be placed either on raised supports or on a specified substrate of known thermal conductivity and thermal capacity within the enclosure and so spaced from other items as to avoid shielding from the source of radiation orr e-radiated heat [*see* 5.6 of IS : 9001 (Part 11)-1973*].

6.2 During the entire test the irradiation, the temperature within the enclosure, the humidity and any other specified environmental conditions shall be maintained at the levels appropriate to the particular test procedure as called for in the relevant specification.

*Guidance for environmental testing: Part 11 Solar radiation test, (*Redesignation of* IS : 7025-1973).

6.3 The item shall be exposed, for the duration called for in the relevant specification, to one of the following test procedure (*see* Fig. 1).

a) *Procedure A* — A 24 h cycle, with 8 h irradiation and 16 h darkness, repeated as required. (This gives a total irradiation of 8·96 kWh/m^2 per diurnal cycle, which approximates to the most severe natural conditions).

b) *Procedure B* — A 24 h cycle, with 20 h irradiation and 4 h darkness, repeated as required. (This gives a total irradiation of 22·4 kWh/m^2 per diurnal cycle).

c) *Procedure C* — Continuous irradiation, as required.

NOTE — For further information [*see* **4.1** and **4.2** of IS : 9001 (Part 11) - 1973*].

6.4 During irradiation, the temperature within the enclosure shall rise at an approximately linear rate and be maintained at one of the following values:

a) +40°C, or
b) +55°C.

6.4.1 In Procedure A, the temperature within the enclosure shall start rising 2 h before the irradiation period starts.

6.4.2 During the darkness period in Procedure A and B, the temperature within the enclosure shall fall at an approximately linear rate and be maintained at +25°C.

6.4.3 The requirements for irradiation, temperature and time relationships are given in Fig. 1. Throughout the specified test duration, the temperature within the enclosure shall be maintained within ±2°C of that shown for the appropriate procedure.

6.5 If the test described above is to be combined with controlled humidity conditions, the relevant specification shall state this humidity and whether it is to be maintained during:

a) the irradiation periods only,
b) the periods of darkness only, and
c) the whole test duration.

6.6 The test duration, called for in the relevant specification, shall preferably be one of the following:

a) 3 cycles or days,
b) 10 cycles or days, and
c) 56 cycles or days.

NOTE — The duration called for will depend on the object of the test [*see* **4.3** of IS : 9001 (Part 11) - 1973*].

*Guidance for environmental testing: Part 11 Solar radiation test (*Redesignation of* IS : 7025-1973).

6.7 The relevant specification shall state whether the item subjected to this test is to be operated during conditioning.

6.7.1 Where the relevant specification calls for measurements to be made under the specified test conditions, of the surface and internal temperatures attained by the exposed item, all necessary information on the measurement of the temperatures shall be given.

6.8 The relevant specification shall state which preconditioning and recovery requirements, if any, are to be applied.

7. FINAL MEASUREMENTS

7.1 The item(s) shall be visually inspected and electrically and mechanically checked, as required by the relevant specification.

8. INFORMATION TO BE GIVEN IN THE RELEVANT SPECIFICATION

8.1 When this test is included in the relevant specification, the following details shall be given as far as they are appropriate:

	Clause Reference
a) Preconditioning procedure	6.8
b) Electrical and mechanical checks to be made prior to the test	4
c) Description of the substrate and/or the means of support for the item(s) under test, attitude of item(s), relative position of irradiation measurement plane and direction of incident radiation (if other than vertically downwards is required)	6.1
d) Test procedure to be followed (that is, whether *A*, *B* or *C*) and object of test	6.2 and 6.3
e) Temperature within the enclosure required during irradiation (whether +40°C or +55°C)	6.4
f) Maximum permissible air velocity within the enclosure, wherever necessary	5.2
g) Associated humidity conditions, if required	6.5
h) Duration of the test	6.6
j) Operation, checks and temperature measurements required during conditioning	6.7
k) Recovery conditions	6.8
m) Electrical and mechanical checks to be made after the test	7
n) Any other details	—

*Guidance for environmental testing: Part 11 Solar radiation test (*Redesignation of* IS : 7025-1973).

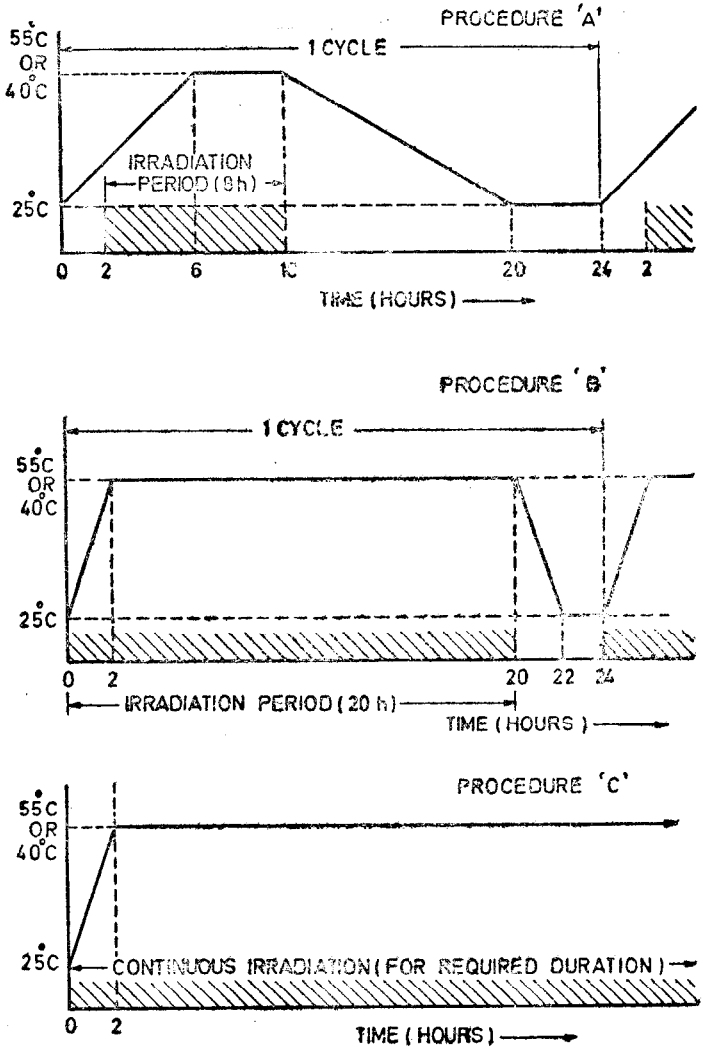


FIG. 1 TEMPERATURE-RADIATION TIME RELATIONSHIP

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m²
Frequency	hertz	Hz	1 Hz = 1 c/s (s⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m²